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Energy Efficiency Improvement by Energy 3R (Reduce, Reuse, Recycle) Activities Using Digital Data

METI Minister's Award
Best Practice Category
FY2023 Energy Conservation Grand Prize

Yuki Satodate
ETRIA Co., Ltd.
November 11, 2025



- 1. Business outline of Ricoh Group, ETRIA**
- 2. Ricoh Group, ETRIA's approach to energy conservation and environment**
- 3. Introduction of energy-saving measures**
 - Solvent recovery system and flameless combustion of exhaust gas**
 - In-house system waste energy recycling technology**
 - Waste energy recovery technology by heat pump**

Ricoh Group Outline

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Ricoh Company, Ltd.

Founded	February 6, 1936
Capital	135.3 billion yen * As of March 31, 2025
President and CEO	Akira Oyama
Group Headquarters	3-6, Nakamagome 1-chome, Ohta-ku, Tokyo, Japan



Akira Oyama
President and CEO
Ricoh Company, Ltd.

Ricoh Group Consolidated

Subsidiaries	254
Number of Employees	78,665 * As of March 31, 2025
Sales	2,527.8 billion yen * Year ended March 31, 2025

RICOH Digital Services

Office Services and Office Printing (sales)

Value provided _____

Solutions for people working in **offices and remotely**
Solutions for **frontline workers**



Scrum Packages

Providing digital transformation support through industry and business packages for small and medium-sized businesses that combine MFPs and other unique devices with software

RICOH Digital Products

Office Printing (development, production and OEM)

Value provided _____

Edge devices connecting workers
Manufacturing that supports digital services

「省エネ大賞」において、製品・ビジネスモデル部門「省エネルギーセンター」会長賞を受賞

A3 Color MFPs

Featuring an industry-leading post-consumer recycled plastic content rate of more than 50%, helping to lower environmental impact

RICOH Graphic Communications

Commercial Printing and Industrial Printing

Value provided _____

Solutions for **printing site** workers



Commercial Printing

Converting from offset to digital printing to digitalize printing processes and shrink carbon footprints

Label-Free Thermal Printing

Direct printing technology for salad package wrappers and other packaging materials helps reduce film waste

RICOH Industrial Solutions

Thermal Media and Smart Industrial Solutions businesses

Value provided _____

Solutions for **manufacturing, logistics, and industry** workers

RICOH Futures

Smart Vision, healthcare, inkjet battery, and social infrastructure businesses

Value provided _____

Creating **new businesses** to resolve social issues



RICOH360

Streamlining businesses through 360° digitalization for all sorts of spaces

Outline of ETRIA Group

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ETRIA CO., LTD.

Establishment	1st July, 2024
Head Office Address	16F Yokohama Gate Tower, 1-2-5 Takashima, Nishi-ku, Yokohama, Kanagawa, Japan
Business Operations	Development, production, and sales, of office, industrial, and optical equipment, as well as their peripheral equipment, consumable supplies, etc.
Representative Director	Katsunori Nakata
Capital	500,000,000 yen
Shareholder composition	Ricoh Company, Ltd. 80.74%, Toshiba Tec Corporation 14.25%, Oki Electric Industry Co., Ltd. 5.01%
Number of Employees	Approx. 3,200 * As of October 1, 2025

ETRIA Group

Number of group companies	17 (in 7 countries)
Number of group employees	Approximately 12,700 * As of October 1, 2025 (Domestic: approx. 3,400; Overseas: approx. 9,300)



Representative Director,
President, and CEO
Katsunori Nakata

- ETRIA has developed and produced high-quality products with advanced technologies, which have been used in various industrial fields.
- ETRIA's current main business area is supplying the products to brand owners such as Ricoh, Toshiba Tec and Oki Electric Industry.



Business Portfolio: Multifunction Printer

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We develop and produce products that boast advanced technology and high quality, and are used in a wide variety of industrial fields.

Currently, ETRIA's primary business area is supplying products to brand owners Ricoh and Toshiba Tec.

Printing System Product

Multifunction Printer (MFP)



Option equipment

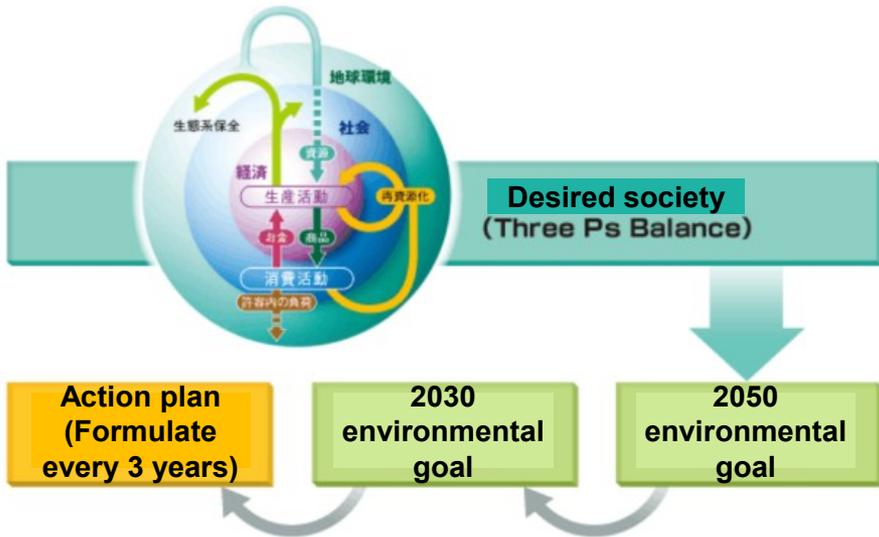
Document Feeder, Paper Tray, Finisher



<Ricoh Group's approach to the environment>

Ricoh Group has been engaged in environmental preservation activities since the 1970s. In 1998, it proposed a concept of “environmental management” as a management policy. It has been promoting sustainability activities based on a management strategy “**Integration of ESG and Business Growth**”.

[Setting the goal by backcasting]



[Participating in various initiatives]

- RE100
<https://www.there100.org/>
- Science Based Targets (SBT)
<https://sciencebasedtargets.org/>
- Task Force on Climate-related Financial Disclosures (TCFD)
<https://www.fsb-tcfd.org/>
- RE 100 | CDP
- Science Based Targets
- TCFD
- Japan Climate Leaders' Partnership (JCLP)
<https://japan-clp.jp/>
- Japan Climate Initiative (JCI)
<https://japanclimate.org/>
- JCLP
- JAPAN CLIMATE INITIATIVE

Contributing to solutions of social issues through all business activities

Outline of Numazu Plant

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<Plant outline>

Start of operations: 1960

Location: Numazu, Shizuoka

Products:

Toners, OPCs*1, inks, key parts, key units, thermal paper

*1 Organic photo conductor

Supply products for image formation

Photosensitive drums (OPCs)



Ink jet inks

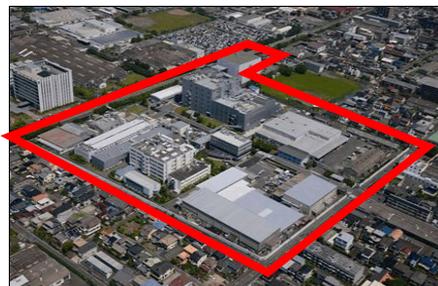


Toners, developers



Development to production of “supply products for image formation” and “key parts” used for image system devices such as MFP

South plant Site area: 78,137 m²

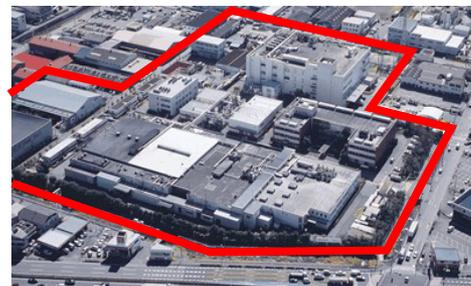


Type 1 designated energy management factory

11,951 kl/year

<Result of FY2022>

North plant Site area: 51,393 m²



Type 1 designated energy management factory

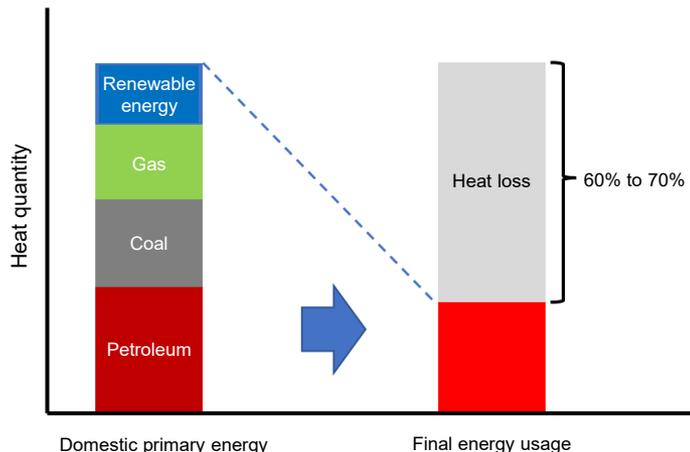
5,620 kl/year

<Result of FY2022>

Concept of Energy-saving Activities

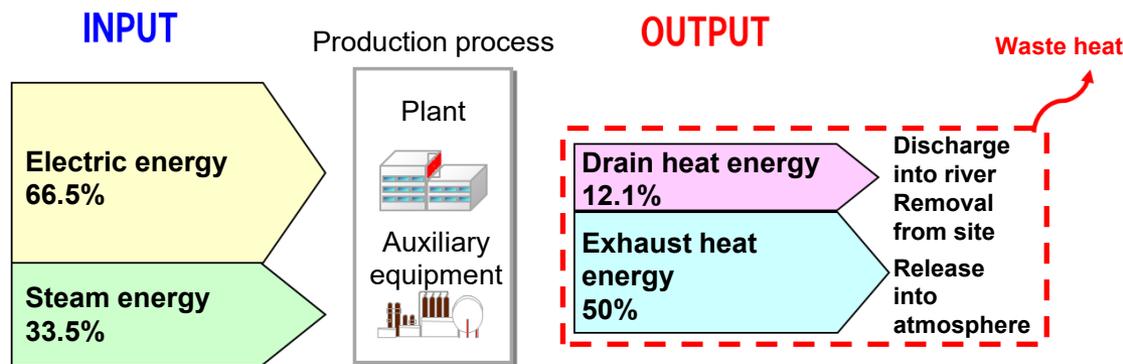
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<Domestic energy usage>



Source: Agency for Natural Resources and Energy, FY2017 Energy Demand Performance (Bulletin), NEDO Innovative Technology Development for Unused Heat Energy, Business introduction brochure

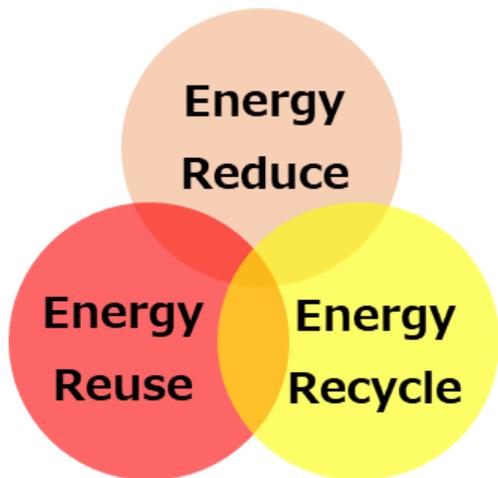
<Energy balance in polymerized toner production plant>



A polymerized toner plant also externally releases 62% of input energy as waste heat.

→ Focus on unused energy

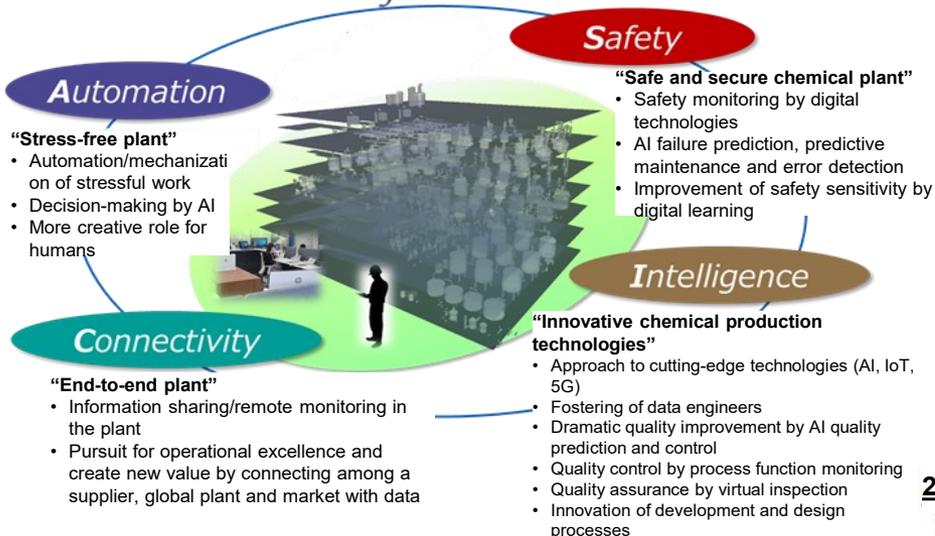
<Energy 3R>



Without wasting the discarded heat, expand activities for energy as well from a 3R viewpoint.

<Concept of cutting-edge autonomous plant>

Be Smart & Excellence Operation



Approach to DX

Already built a detailed data acquisition environment by promoting plant digitalization



Practicable efficient energy-saving activities by utilizing data

1. Building of quality prediction and control system

Conventionally

Checking 20 or more quality items every day, quality control personnel manually instruct detailed manufacturing conditions through trials and errors.



Now

A computer predicts the quality and instructs the next action.



Source: The 7th SICE Multi-Symposium on Control Systems, 2A-3 (2020)

2. Error detection and automatic operation of the plant

Conventionally

There are about 5,000 sensors from which 80,000 data are acquired every day. It is beyond human limits to manage such a large amount of data every day!



* The photo is for an illustrative purpose and differs from an actual site.

Now

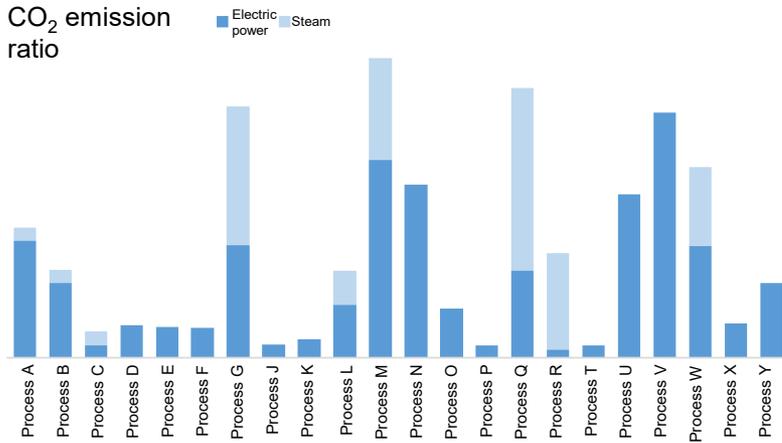
An error is immediately informed to a work site, if any!

A computer manages 80,000 data acquired from all sensors and continues automatic operation if there is no error.

As a result, 95% of the toner production process are now automatically operated, allowing to sense an error unnoticeable to humans and take care of it at once!

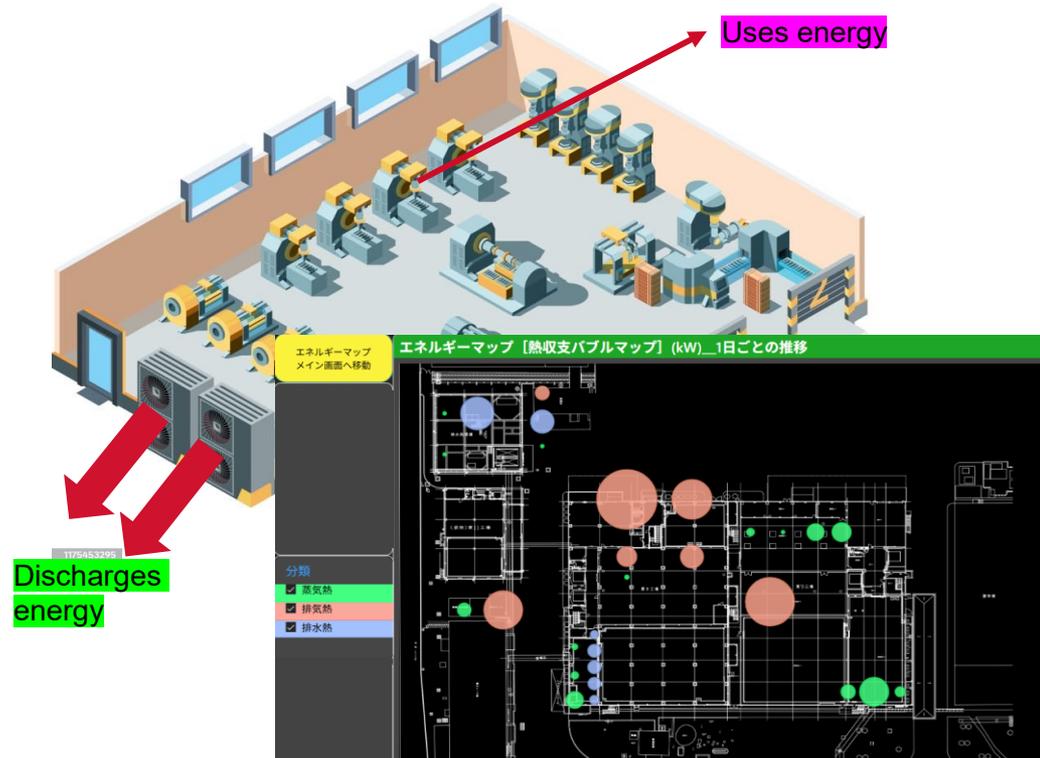


<Understanding of CO₂ emissions for each process>



Visualized CO₂ emission ratios for each process

<Energy map>



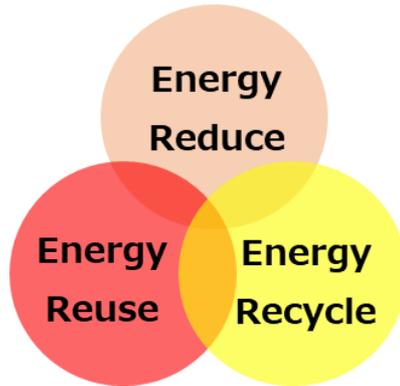
Visualized waste heat and heat supply status

Visualize energy balances for each process to determine reduction targets. Plan an energy 3R concept effectively by **energy mapping**.

Major Energy-saving Achievements

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Energy-saving activities were carried out from a 3R viewpoint as to the reduction targets determined by visualization.

<Activity results from 3R viewpoint>

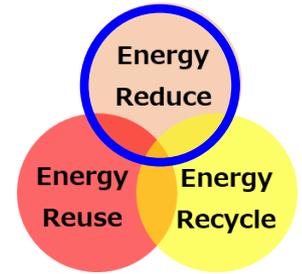
3R viewpoint	content	amount of energy reduction reduction of crude oil equivalent (reduction rate)	installation timing
Reduce	Solvent recovery system and flameless combustion of exhaust gas	202kL/year (69%)	Sep-19
Reuse	In-house system waste energy recycling technology	692kL/year (82%)	Sep-19
Recycle	Waste energy recovery technology by heat pump	117kL/year (27%)	Feb-22
3R	total	1,011kL/year	

Energy Reduction Example

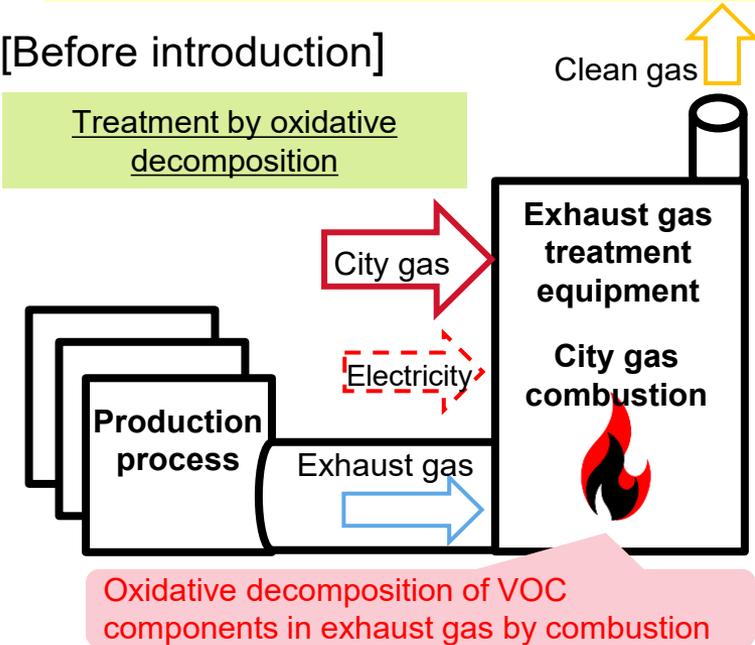
Solvent recovery system and flameless combustion of exhaust gas

<Features of exhaust gas treatment equipment>

Volatile organic compounds (VOCs) were generated in the production process at a polymerized toner production plant.
→ In order to prevent their release into the atmosphere, the VOCs were treated by an “exhaust gas treatment equipment”.

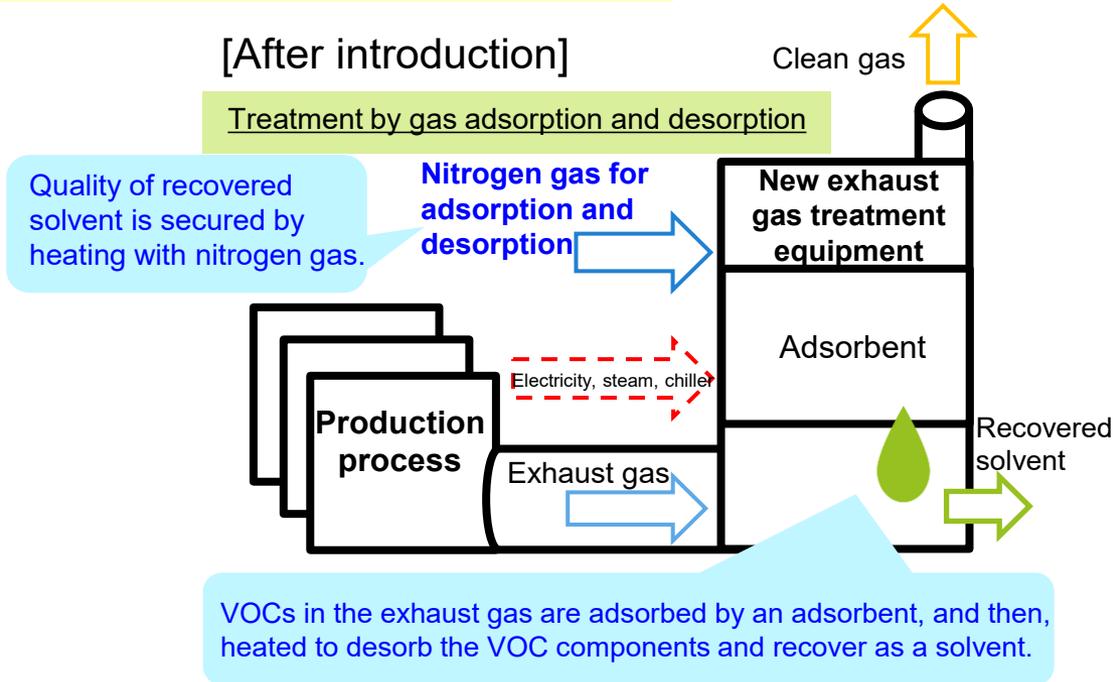


[Before introduction]



VOCs are treated by combustion with a city gas.
→ A large volume of city gas is directly used.
* **Direct use of fossil fuel**

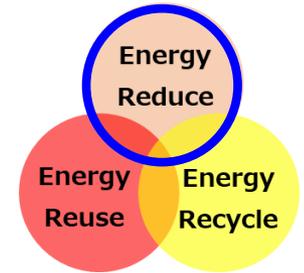
[After introduction]



VOCs are treated by absorbing and desorbing them with the adsorbent.
→ A conventionally combusted solvent is also recovered and recycled.
→ No direct use of city gas
* **“Reduction” of city gas is realized.**

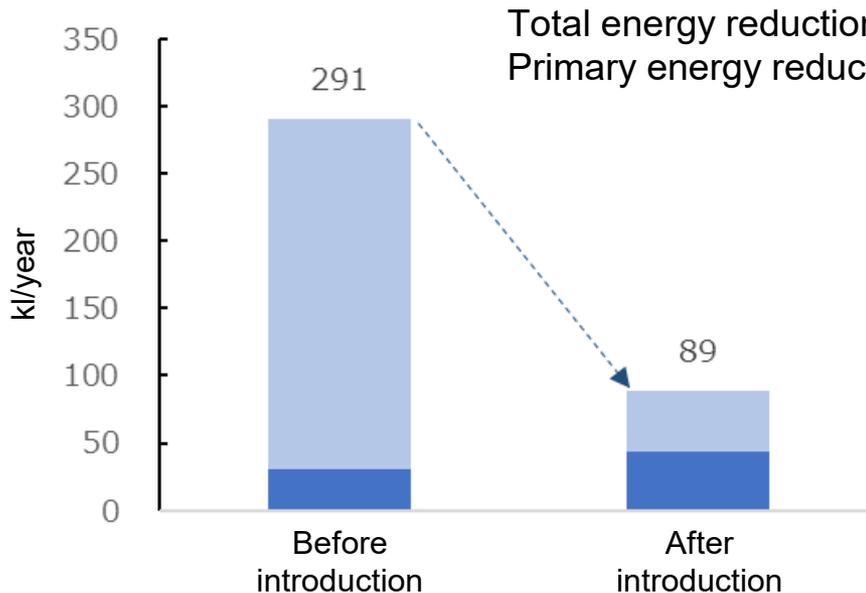
<Crude oil reduction effects>

Introduction of the new exhaust gas treatment equipment has realized reduction of crude oil equivalent by 202 kl/year.



Reduction of crude oil by exhaust gas treatment equipment

■ City gas ■ Electricity



Before introduction
Direct use of a large volume of city gas
→ Energy in crude oil equivalent: 291 kl/year

After introduction
No direct use of city gas
→ Energy in crude oil equivalent: 89 kl/year

Use of “nitrogen” as a carrier gas has succeeded in solvent recovery and reuse. → 118 t/year
* Simultaneous realization of “reuse” of resources
Compared with production and transportation of a new solvent, 340 tons of CO₂ have been reduced annually by recycling.

Energy Reuse Example

In-house system waste energy recycling technology

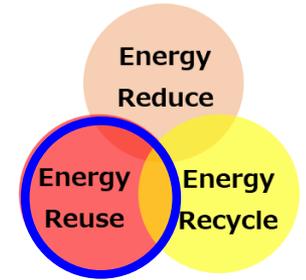
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<Features of concentration equipment>

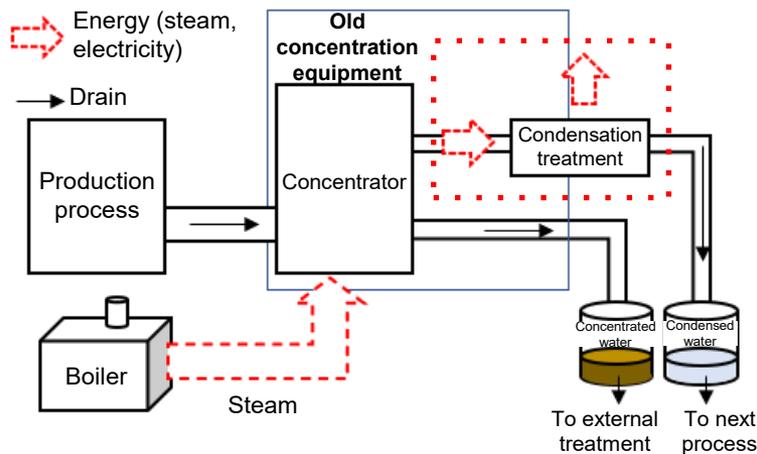
A polymerized toner production plant generated drain difficult to be biologically treated.

→ “Concentration equipment” has been used to reduce a waste volume.



[Before introduction]

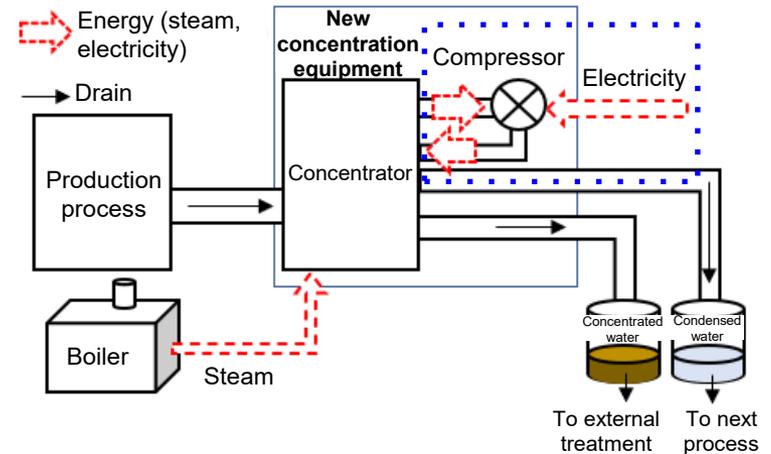
Releasing heat energy into atmosphere



Steam was always supplied to concentrate.
→ The evaporation heat generated at volume reduction time was **released into the atmosphere** together with heat energy.

[After introduction]

Reusing heat energy



The evaporation heat generated at volume reduction time is recovered and reused as heat energy.

→ Steam required for concentration has been greatly reduced.

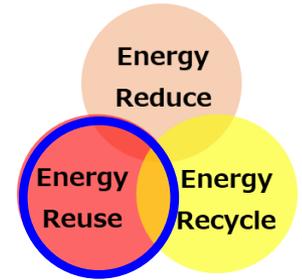
* “Reuse” of heat energy is realized.

Energy Reuse Example

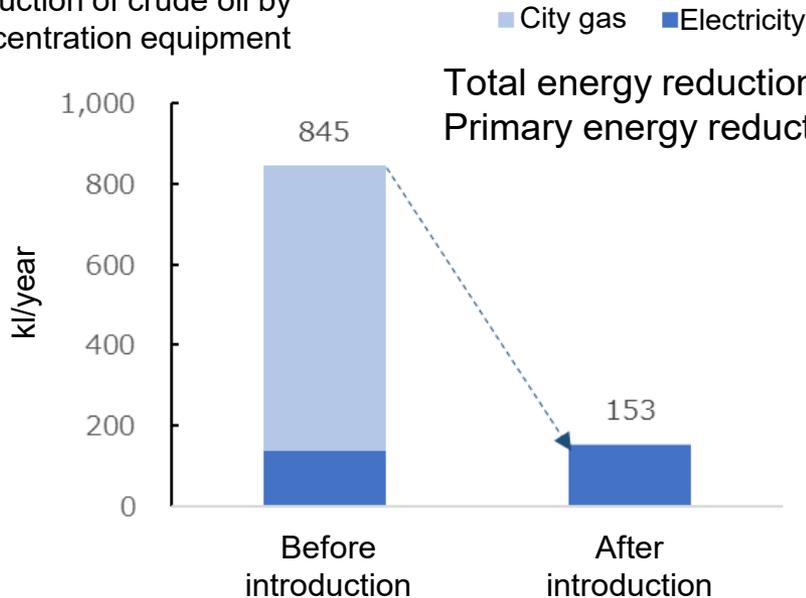
In-house system waste energy recycling technology

<Crude oil reduction effects>

Introduction of the new concentration equipment has realized reduction of crude oil equivalent by 692 kl/year.



Reduction of crude oil by concentration equipment



Total energy reduction rate: 82%
Primary energy reduction rate: 99%

Before introduction
Direct use of a large volume of steam
→ Energy in crude oil equivalent: 845 kl/year

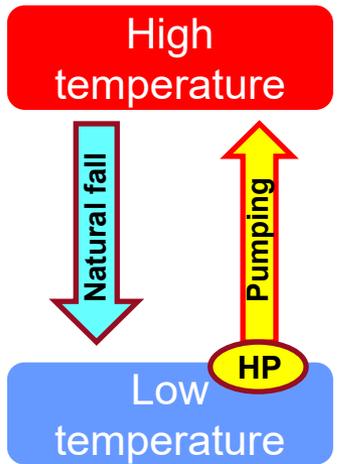
After introduction
Significant reduction of steam consumption
→ Energy in crude oil equivalent: 153 kl/year

Energy consumption has been significantly reduced.

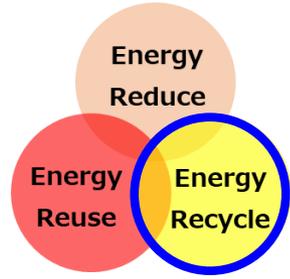
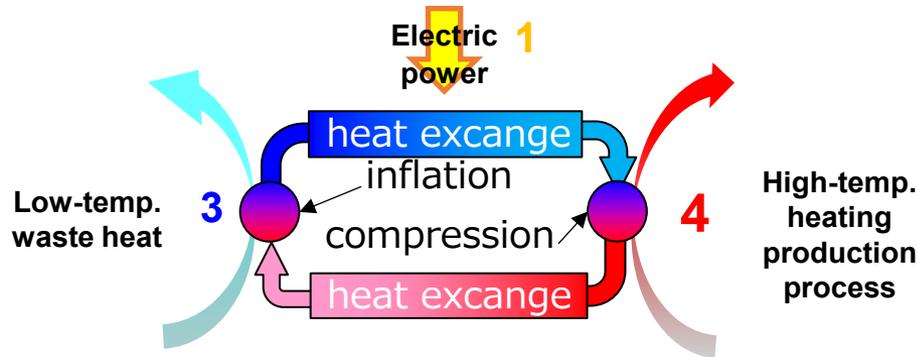
Energy Recycling Example

Waste energy recovery technology by heat pump

<Features of heat pump>



Electric power 1 + Low-temp. waste heat 3
 → Heat energy 4



Normally, energy moves from the high-temperature side to the low-temperature side, but it can be pumped from a low-temperature region by a heat pump.

	Advantage	Issue
Electric heating (Heat pump)	<ul style="list-style-type: none"> • Capable of recovering and utilizing low-temperature waste heat. • Capable of severalfold heating with low input energy. 	Compared with steam heating, <ul style="list-style-type: none"> • Stable heat supply required • Stable heat demand required • Low thermal responsiveness

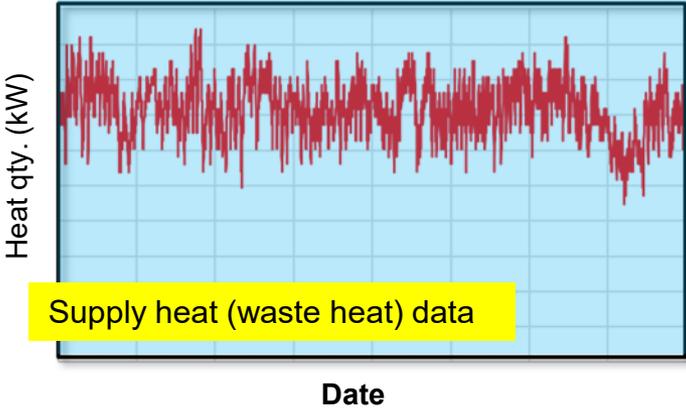
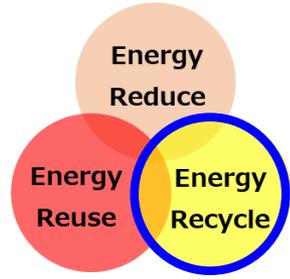
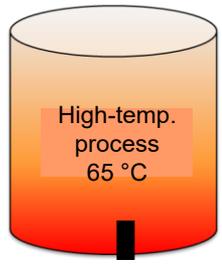
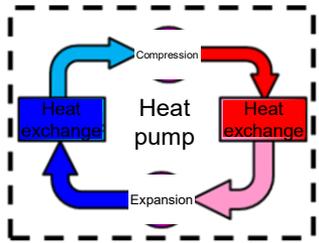
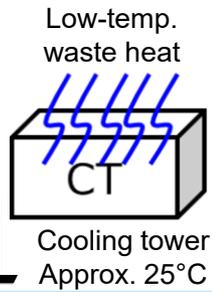
The heat pump has a lot of advantages, but the equipment is not easy to design due to low practicability.
 → To successfully introduce the equipment, it is important to collect and verify data in detail throughout the year.

Energy Recycling Example

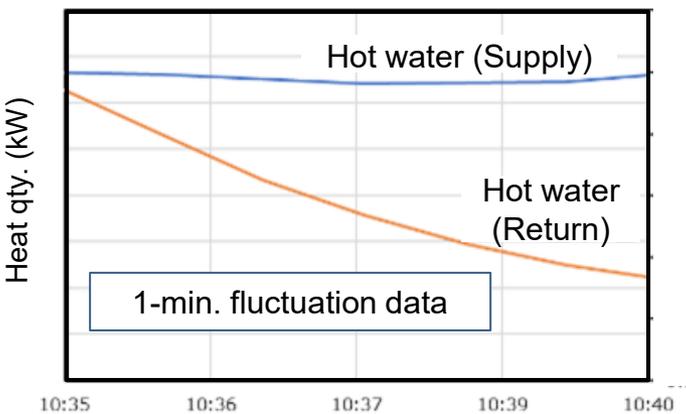
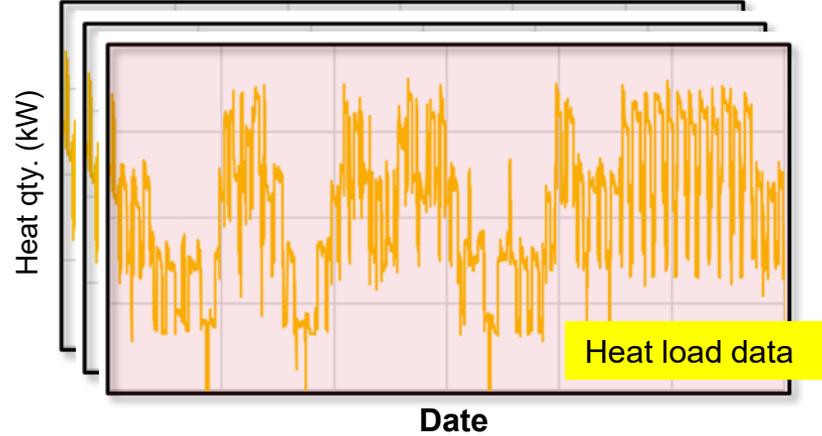
Waste energy recovery technology by heat pump

<Prior data analysis>

- Inlet/outlet temperature data
- Flow rate data



Long-term data



Based on the acquired data,

- **Stable heat supply: Yes**
- **Stable heat load: Yes**
- **Short-term fluctuation: Low**

→ Determined it possible to effectively utilize the heat pump.

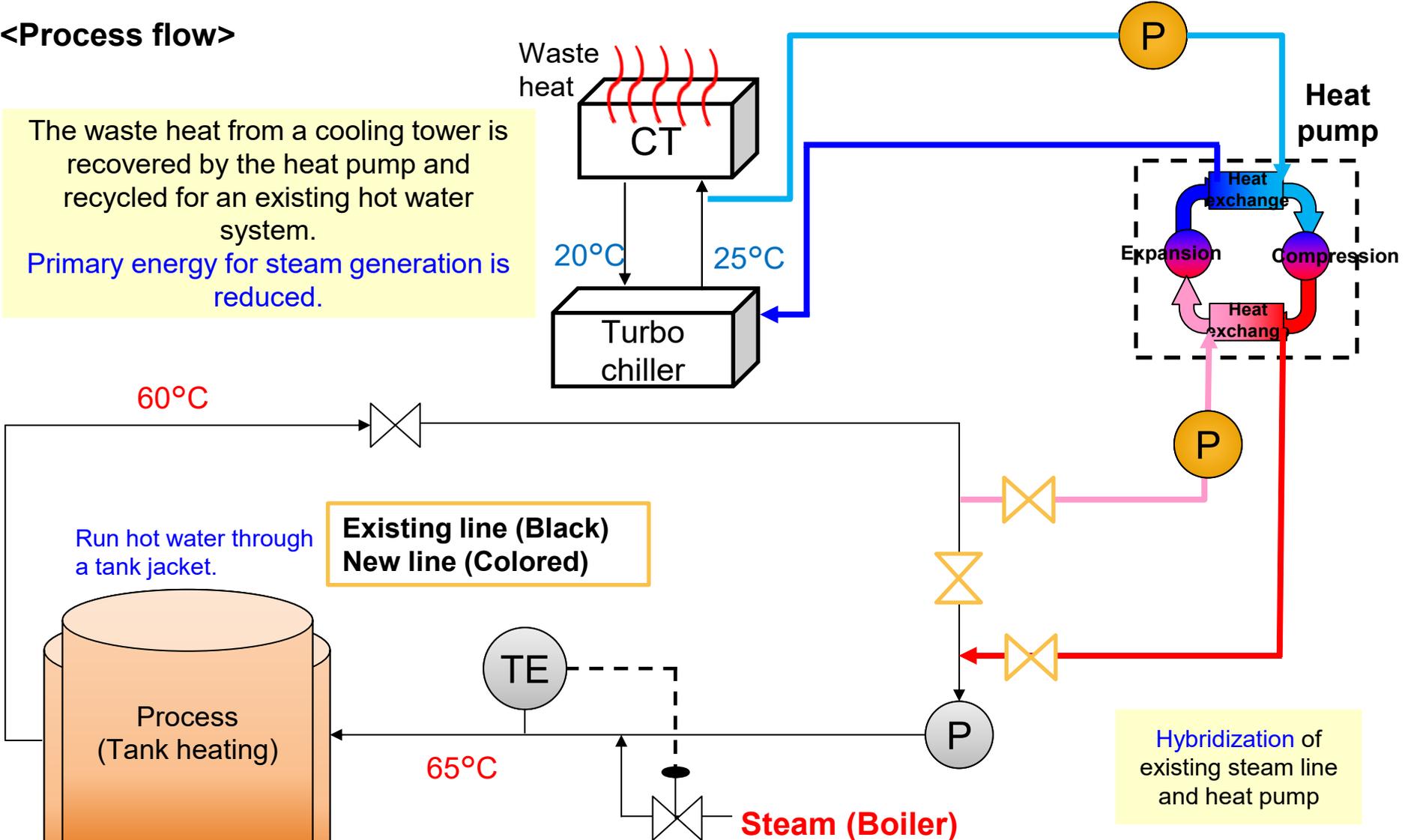
Based on these sample data and the annual operating status of the plant, simulate the operating status of the heat pump to calculate a predicted outcome.

Energy Recycling Example

Waste energy recovery technology by heat pump

<Process flow>

The waste heat from a cooling tower is recovered by the heat pump and recycled for an existing hot water system. Primary energy for steam generation is reduced.

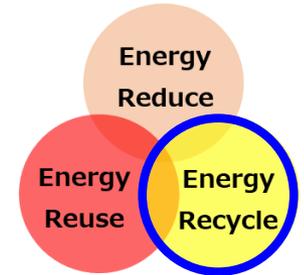


Energy Recycling Example

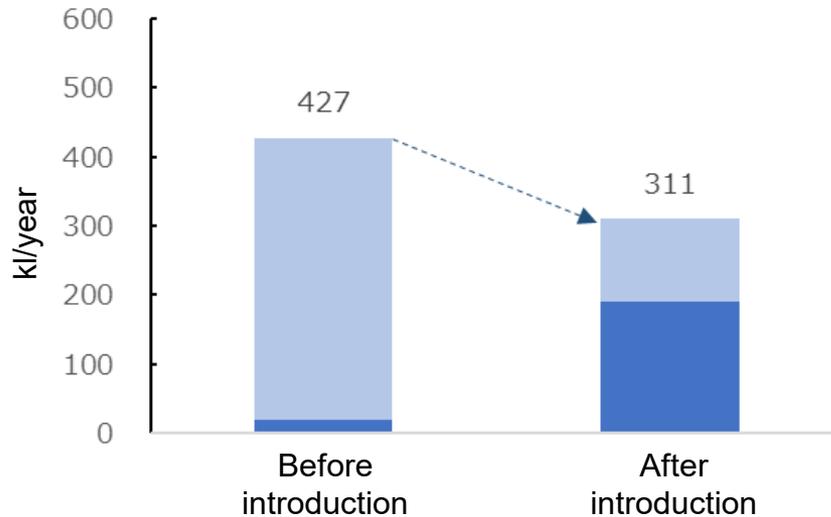
Waste energy recovery technology by heat pump

<Crude oil reduction effects>

Introduction of the waste heat recovery heat pump has realized reduction of crude oil equivalent by 116 kl/year.



Reduction of crude oil by heat pump ■ City gas ■ Electricity



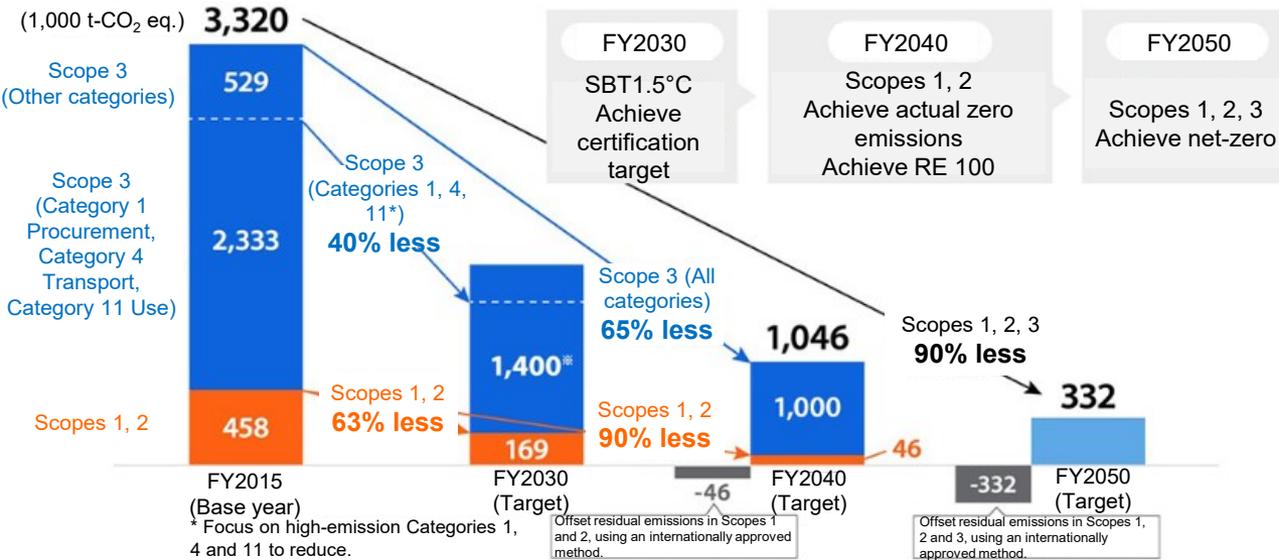
Total energy reduction rate: 27%
Primary energy reduction rate: 70%

Simulated effects have been realized.

Digital technology has resulted in effective waste heat recovery.

Future Approach

<Ricoh Group's Decarbonization Roadmap>



GHG Scopes 1 and 2

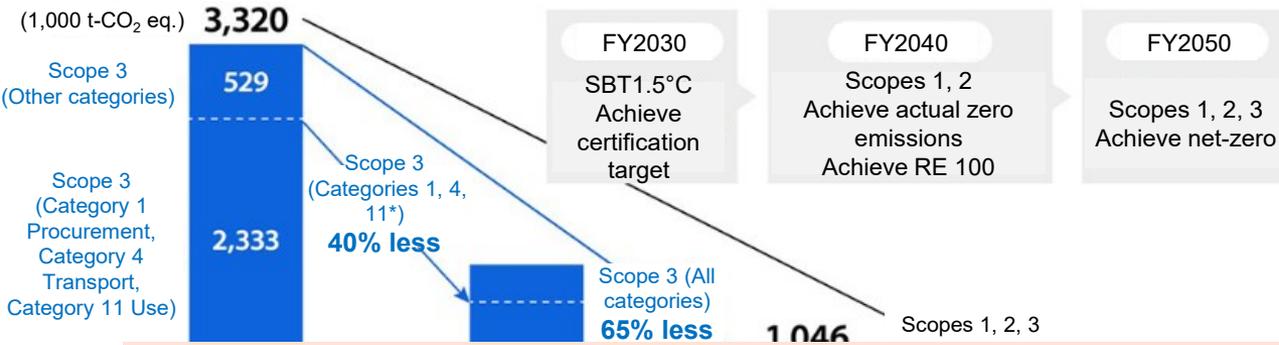
	FY2015 (Base year)	FY2021	FY2022	FY2023	FY2024
Emissions (1,000 t-CO ₂ eq.)	481.1	291.1	273.6	252.8	196.6
Reduction rate (compared with FY2015)	—	39.5%	43.1%	47.4%	59.1%

GHG Scope 3

	FY2015 (Base year)	FY2021	FY2022	FY2023	FY2024
Emissions (1,000 t-CO ₂ eq.)	2,344	1,540	1,604	1,450	1,247
Reduction rate (compared with FY2015)	—	34.3%	31.6%	38.1%	46.8%

Development and expansion of environmental technologies lead Ricoh Group's decarbonization activities.

<Ricoh Group's Decarbonization Roadmap>



Aiming to solve social issues through business, Ricoh Group will contribute to building a sustainable society.

GHG Scope 1	FY2015	FY2021	FY2022	FY2023	FY2024
Emissions (1,000 t-CO ₂ eq.)	481.1	291.1	273.6	252.8	196.6
Reduction rate (compared with FY2015)	—	39.5%	43.1%	47.4%	59.1%

GHG Scope 3	FY2015 (Base year)	FY2021	FY2022	FY2023	FY2024
Emissions (1,000 t-CO ₂ eq.)	2,344	1,540	1,604	1,450	1,247
Reduction rate (compared with FY2015)	—	34.3%	31.6%	38.1%	46.8%

Development and expansion of environmental technologies lead Ricoh Group's decarbonization activities.

Thank you very much for your attention

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